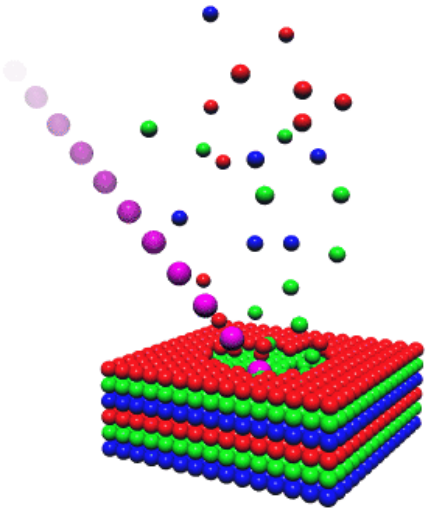
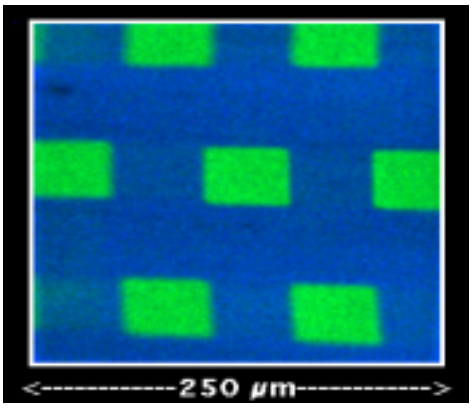
Chemical microscopy by SIMS

- Critical Issues
  - The use of high-throughput combinatorial synthesis is of growing interest to the chemical and advanced materials industries for development of new polymer, optical, catalytic, electronic and magnetic materials. Of critical importance is the development of metrology tools for the rapid characterization of the elemental and molecular composition of both bulk and thin-film combinatorial array structures.
- Research Strategy
  - The objective of our research is to apply secondary ion mass spectrometry (SIMS) imaging for high-speed elemental and molecular analysis of combinatorial arrays at micrometer spatial resolution. A unique feature of the NIST SIMS instrumentation is the ability to generate chemical maps in parallel providing very rapid screening of arrays. SIMS is ideally suited for the compositional characterization of the chemically complex materials produced using combinatorial methodologies because of its ability to detect both elemental and molecular species with a spatial resolution better than 1 μm and an in-depth resolution approaching 1 nm.
- Research Highlights
  - The Analytical Microscopy Group has extensive experience in applying state-of-the-art SIMS tools for the quantitative chemical microscopy of elemental species on the micrometer spatial scale. In addition to elemental analysis, we have also developed a capability for "molecular imaging" where the spatial distribution of a compound of interest on a sample surface can be determined by ion-induced desorption of characteristic molecular ions. This is demonstrated in the figure below which shows a SIMS image of a patterned micro-array of DNA probes on a gold surface. The green and blue areas show the detected locations of the thymine- and cytosine-containing probes, respectively. Another unique feature of SIMS is a capability for probing the composition of an array element as a function of depth. This may be relevant for the characterization of combinatorial multilayer and superlattice structures.





For more information ...

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